Strain effect on the magnetic and structural properties of $Ba(Fe_{1-x}Co_x)_2As_2$

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Most of the iron pnictide superconductors in the underdoped regime undergo structural and magnetic transitions from a high temperature tetragonal nonmagnetic phase to a low temperature orthorhombic antiferromagnetic phase. However, the origin of these transitions, in particular the structural distortion, is still the subject of research. One of the most widely considered proposals is that these transitions are the secondary manifestations of high temperature electronic anisotropic phase. Thus, the study of high temperature electronic anisotropy is very important to understand the origin of these transitions. The study of this electronic anisotropy always involves some external biasing field, mostly uniaxial pressure along one of the in-plane orthorhombic axes. Our study is focused on the effect of uniaxial pressure on the structural and magnetic phase behavior of both parent and underdoped systems of $Ba(Fe_{1-x}Co_x)_2As_2$.

We performed neutron diffraction experiments on N-5 and C-5 triple axis spectrometers on $Ba(Fe_{1-x}Co_x)_2As_2$ system in the presence of uniaxial pressure applied along orthorhombic b-axis for x = 0, 0.015, 0.03 and 0.06. Our study shows that uniaxial pressure induces a thermal shift in the onset of antiferromagnetic order independent of cobalt concentration. However, the thermal shift increases as a percentage of T_N as cobalt doping is increased [Figure 1] and superconducting phase is approached.

Our study not only shows the thermal shift of onset of magnetic order but also shows that the structural and magnetic transitions are decoupled for all samples studied. This study points toward the varying response of orbital-lattice and spin-lattice coupling which respectively tune structural and magnetic transitions. These results are being submitted for publication in Physical Review B.

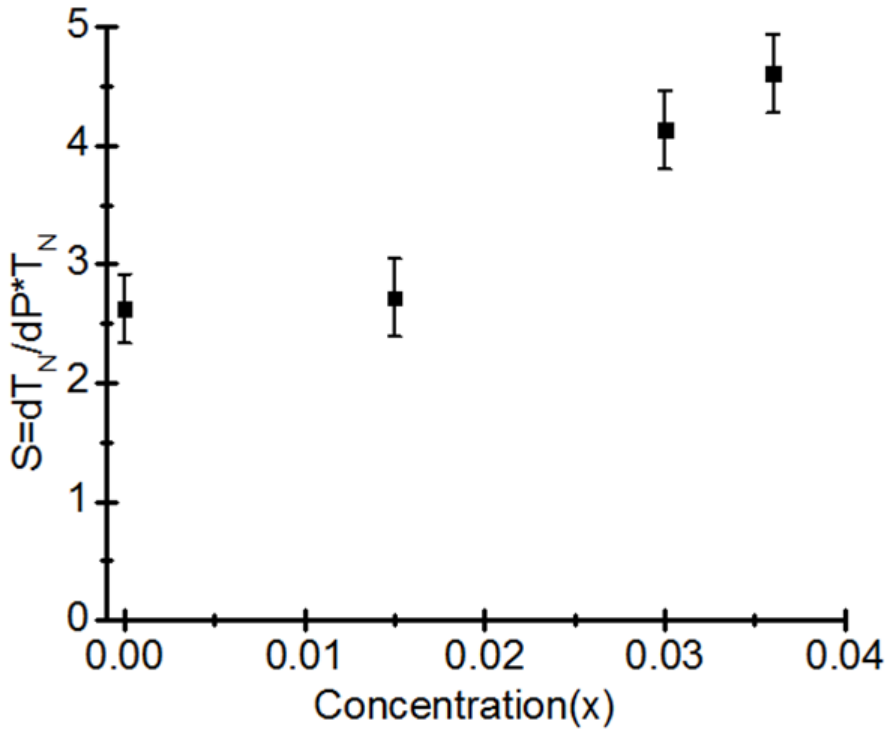

Figure 1 Change in T_N as fraction of T_N and applied uniaxial pressure.